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ORIGINAL ARTICLE

Hospital ownership and drug utilization under a global budget: a quantile regression analysis

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Background: A global budgeting system helps control the growth of healthcare spending by setting expenditure ceilings. However, the hospital global budget implemented in Taiwan in 2002 included a special provision: drug expenditures are reimbursed at face value, while other expenditures are subject to discounting. That gives hospitals, particularly those that are for-profit, an incentive to increase drug expenditures in treating patients.

Methods: We calculated monthly drug expenditures by hospital departments from January 1997 to June 2006, using a sample of 348 193 patient claims to Taiwan National Health Insurance. To allow for variation among responses by departments with differing reliance on drugs and among hospitals of different ownerships, we used quantile regression to identify the effect of the hospital global budget on drug expenditures.

Results: Although drug expenditure increased in all hospital departments after the enactment of the hospital global budget, departments in for-profit hospitals that rely more heavily on drug treatments increased drug spending more, relative to public hospitals.

Conclusions: Our findings suggest that a global budgeting system with special reimbursement provisions for certain treatment categories may alter treatment decisions and may undermine cost-containment goals, particularly among for-profit hospitals.

Keywords: Drug use, Global budget, Ownership type, Quantile regression

Introduction

A global budget is 'an overall spending target or limit that constrains the price and the quality of the services provided'.[1] As such, it is a method to control aggregate spending on healthcare and therefore a method by which a society can choose how much to spend on healthcare and how healthcare spending will increase over time.[2,3] Global budgeting systems are widely used in a number of countries, including England, France, Germany, Canada and Taiwan. In the USA, the Veterans Administration budget functions as a type of global budget.[4–7] Ideally, a global budget system also encourages healthcare professionals to use their expertise to allocate medical resources. However, the incentives created by a global budget may cause providers, particularly for-profit ones, to alter the quantity or quality of care provided to patients in ways that maximize profit, thus undermining cost control and potentially affecting important healthcare decisions. In this paper we examine whether the effect of the global budget implemented by Taiwan on hospital drug expenditure varies among hospitals with different types of ownership.

In March 1995 Taiwan enacted National Health Insurance (NHI) to provide universal and comprehensive coverage.[8] At first, healthcare providers were reimbursed on a traditional fee-for-service (FFS) basis, but, in anticipation of rising costs, the NHI Act specifically called for the adoption of global budgeting. Taiwan has gradually imposed global budgets on each different healthcare sector covered by NHI (dental services, traditional outpatient Chinese medical services, Western-based medical clinics, and hospitals providing Western-based inpatient and outpatient medical care). Hospitals providing care based on Western medicine were shifted to a global budget on 1 July 2002.

The global budget that Taiwan adopted for these hospitals has two important features. First, the budget is a 'hard' cap[9] set at the regional level; that is, a fixed sum is allocated to each of six regions to cover inpatient and outpatient expenditures by all hospitals in that region. Unlike a global budget with a 'soft' cap, which can be exceeded if need be, the hard cap global budgets in Taiwan are fixed 'ex ante' (before the event) and are reconciled with the actual volume of services provided by adjusting the rate for each unit of medical service, known as the point value, 'ex post'

(after the event).[10] That is, although technically providers continue to be reimbursed on a FFS basis, the fees are uncertain ex ante because the point value for a unit of service is discounted if necessary to ensure that total regional expenditures do not exceed the global budget. Hospitals within each region thus compete for shares of the budget by competing for patients, and each hospital has an individual incentive to increase services so as to win a greater share of the global budget, even though collectively this response causes the point value to decline.[6]

The second important feature is that the hospitals are reimbursed differently for drug expenditures and for spending on other services. Expenditures on drugs are reimbursed from the global budget at their ex ante point value, before the ex post point value used to reimburse non-drug services is calculated.[10] That is, unlike reimbursements for non-drug services, reimbursements for drugs are not discounted to meet the global budget target. Drug expenditures therefore represent a risk-free and usually profitable flow of income for hospitals, giving them an incentive to treat patients with drugs rather that provide other types of care.[6]

The Bureau of National Health Insurance (BNHI) adopted several strategies to monitor drug use both before and after enacting the global budget, including developing drug use guidelines, auditing more claims, and instituting provider profiling (comparing costs and prescribing patterns among peer providers) and utilization review.[11] Despite these drug cost containment strategies, recent studies of this global budgeting system show that hospitals increased their use of drugs after its implementation.[6,11–13] It remains unclear, however, whether the size of the response varies among hospitals with different owner types.

In Taiwan, public hospitals are managed by the government directly, or by public enterprises or public universities. Each year government funds are allocated to partially finance long-term investments and operating expenditures of these hospitals. In contrast, private for-profit (FP) hospitals are owned and operated by physicians who are the residual claimants, while not-for-profit (NFP) hospitals are owned by private universities, charitable groups or groups funding medical research and are subject to a non-distribution constraint.[14] NFP hospitals enjoy substantial tax advantages or exemptions from income, land and property taxes, which FP hospitals do not. Further, most NFP hospitals are financed by large charitable donations, while FP hospitals have to be financed by non-tax-exempt personal debt and their operating profit.[14]

Studies in the USA suggest that FP hospitals have a stronger incentive to maximize cash flows than do NPF or public hospitals,[15] that profit incentives affect physicians' prescribing decisions[16] and that prescribing decisions in private hospitals, especially FP hospitals, are more responsive than public hospitals to changes in financial incentives.[17,18] Similar behavior patterns have been documented for hospitals in Taiwan.[14,19] Consequently, we expect that FP hospitals may respond more aggressively than NFP or public hospitals to the incentives created by the global budget.

Further, the effect of ownership may vary among different types of hospital department according to their reliance on drugs to treat patients. In Taiwan, physicians are employed by the hospital, and so we may in general expect their decisions to be strongly influenced by hospital strategies adopted in response to the global budgeting system. However, physicians in departments where drugs already form a large part of regular treatment, such as those treating patients for hypertension, diabetes or schizophrenia, may find it easier to increase drug use, by using drugs more intensively or substituting them for non-drug treatments.[20] Conversely, physicians in departments relying more on non-drug treatments for their standard care, for instance surgical departments, may find that increasing the volume of non-drug services is a more attractive means of increasing their share of the global budget because monitoring of drug use by BNHI makes substantial increases in drug treatments problematic.[21] Therefore, we study in this paper the effect of the hospital global budget by examining expenditure on drugs prescribed for outpatients by departments within hospitals under different types of ownership, before and after the implementation of the global budget.

Methods

Conventional ordinary least squares (OLS) regression estimates the average impact of the global budget, but will obscure any heterogeneity in the relationship between department type and drug use.[22,23] Therefore, we estimate the policy's effect using both OLS and quantile regression, because quantile regression estimates the marginal effect of an explanatory variable at a distinct point of the conditional distribution; this allows us to explore the heterogeneous responses of different hospital departments (Table 1) to the global budget with respect to their reliance on drug treatments.[22,23]

Table 1. Taiwan hospital departments during the study period (1997–2006)

Department	Frequency (%)
Primary care	19 804 (5.69)
Internal medicine	43 778 (12.57)
Surgery	38 579 (11.08)
Pediatrics	20 965 (6.02)
Obstetrics and gynecology	27 236 (7.82)
Orthopedics	28 918 (8.31)
Neurosurgery	11 647 (3.34)
Urology	19 034 (5.47)
Ear, nose and throat (ENT)	16 646 (4.78)
Ophthalmology	18 995 (5.46)
Dermatology	15 519 (4.46)
Neurology	14 895 (4.28)
Psychiatrics	17 510 (5.03)
Gastrointestinal	10 630 (3.05)
Cardiovascular	11 260 (3.23)
Thoracic	10 143 (2.91)
Renal	9148 (2.63)
Rheumatoid immune branch	5402 (1.55)
Endocrinology	8062 (2.32)
Other	22 (0.01)
Total	348 193 (100.00)

We use Koenker and Bassett's estimator,[22,23] as implemented in the Stata 12 statistical package (StataCorp LP, College Station, TX, USA) with the command ^*qreg*^,[24,25] in the quantile regressions. Our specification is:

$$Y_{hjkt} = \alpha + \beta_1 GB_t + \beta_2(GB_t * FP_h) + \beta_3(GB_t * NFP_h) + \beta_4 FP_h + \beta_5 NFP_h + \beta_6(GB_t * Chronic_{hjt}) + \beta_7 Chronic_{hjt} + H'_{ht}B + D'_{hjt}B_1 + \beta_8 PV_{kt} + \beta_9 M_t + \gamma_j + \delta_k + \tau_t + \varepsilon_{hjkt},$$

where Y_{jt} is the log of the average drug expenditure per outpatient claim in hospital department j in month t (in 1996 New Taiwan dollars, NT$); GB_t is a dummy variable that equals 1 for all months after June 2002; FP_h and NFP_h are dummy variables identifying FP and NFP hospitals, respectively (with public hospitals serving as the reference group); $Chronic_{hjt}$ is the proportion of patients treated by a hospital department for a chronic (long-term) condition, i.e. one of the 95 chronic illnesses (e.g. hypertension, diabetes or schizophrenia) included on a list published by the Taiwan National Health Bureau.

H_{ht} is a vector of hospital characteristics variables; D_{hjt} is a vector of hospital department characteristics; PV_{kt} is the regional (ex post) point value; M_t is a monthly trend term; and γ_j, δ_k and τ_t are fixed effects for the hospital department's type, its hospital reimbursement region and the year, respectively.

The coefficient of GB_t measures the average response of a hospital department to the global budgeting system. Since hospitals of different ownership types may react differently, we include two interaction terms: $GB_t^*FP_h$ and $GB_t^*NFP_h$; their coefficients (β_2 and β_3) represent, relative to public hospitals, the additional response of FP and NFP hospitals. We also include the interaction term GB_t^*-$Chronic_{hjt}$, because treatments for chronic illnesses consist largely of drug prescriptions and physicians in departments with a higher proportion of patients with a chronic condition are therefore more likely to respond to the incentive provided by the global budget.[12] (In our sample, the ratio of drug expenditures to total expenditures for patients with a chronic illness is on average 40 percentage points higher than the ratio for patients who do not have a chronic condition.)

The hospital characteristics vector H_{ht} includes variables to control for accreditation level and bed size. Accreditation categories include: major teaching hospitals (the reference group), minor teaching hospitals, community hospitals and non-accredited community hospitals.

Major teaching hospitals may be more concerned to maintain or increase their perceived reputation for providing higher quality care than other hospitals. Consequently, they may prefer to prescribe more-expensive branded drugs, which are generally perceived as of higher quality than generic drugs.[19,26] Hospital size is measured by the number of beds.

The hospital department characteristics vector D_{hjt} includes patient characteristic variables: patient age, percent male, percent chronically ill, the proportion of cases diagnosed as diabetes, as hypertension, as arthritis, as heart disease or as psychiatric illness. To mitigate concerns about the possible effects of correlation between current and past drug expenditures, we included the log of average drug expenditures in the preceding month.

The variable PV_{kt} reflects the discount applied to non-drug reimbursements. This variable equals 1 for all regions in the quarters preceding the imposition of the global budget. The variable M_t is a monthly trend variable, included to control for common shocks across all departments at the monthly level.

Finally, the estimation includes several levels of fixed effects. Year fixed effects, τ_t, capture time-related market-wide effects that may alter drug use by all hospital departments, for example, nationwide drug cost containment policies implemented by the BNHI, or the general adoption of new drugs or technologies. Department fixed effects, γ_j, are included to control for time-invariant differences in prescribing behavior across different types of departments. Regional fixed effects, δ_k, are included to control for the NHI administrative region in which a hospital is located.

Sample and data

Our dependent variable is the average drug expenditure per outpatient visit by a hospital department in a given month. Drug expenditure is calculated from data in the NHI Database, which includes claims for healthcare use by all NHI enrollees in Taiwan each year (virtually the entire population). Each claim includes information on the patient's diagnoses, case-type (e.g. emergency or outpatient surgery), and dates of treatment, and on the hospital departments that provided the services. In addition, the outpatient claim includes detailed records of reimbursement, such as drug, diagnosis and examination,[15] and a hospital identifier that allows us to link hospital basic files to obtain a hospital's accreditation, ownership status and zip-code.

Our data are derived from the 2005 NHI 1 million sample, which is a random sample of 1 million NHI enrollees, roughly 5% of the Taiwan population, from the 2005 eligibility files. All outpatient claims for these 1 million enrollees between January 1997 and June 2006 were obtained. We restricted our attention to outpatient visits because drugs are the principal means for treating outpatients in hospitals, and because expenditures on inpatient care may vary widely if, for example, expensive equipment is used in treatment. Focusing on outpatients thus reduces heterogeneity in the cost of patient care that is unrelated to doctors' prescribing behavior.

We also excluded all claims for: 1. services provided by local clinics or in the form of Chinese medicine or for dental care; as noted above, these are covered by different global budgets than that covering Western-medicine hospitals; 2. dialysis and surgeries performed at outpatient visits because, as for drug expenditures, these services are reimbursed at face value; 3. treatments for patients that had zero co-payments (low-income patients), because behaviors of these patients are likely to differ significantly from those of the average patient.

Finally, the individual patient claims were condensed to the monthly hospital-department level. In total, we have 348 193 observations of the average drug expenditures on outpatients at a department in a hospital in a given month from January 1997 through June 2006. Table 2 presents descriptive statistics for the dependent variable before and after the global budgeting system was adopted and for the independent variables described above. In Table 3, we show how the control variables vary by hospital ownership.

Table 2. Descriptive statistics of explanatory variables included in quantile regressions in a study to identify the effect of the hospital global budget on drug expenditures in Taiwan hospitals, 1997–2006

	Mean	SD
Dependent variable		
Average drug expenditure per hospital department visit (1996 NT$[a])		
January 1997–June 2002	385.0	351.4
July 2002–June 2006	493.4	936.2
Explanatory variables		
Point value of global budget	0.95	0.07
Hospital characteristics		
Hospital ownership (%)		
For-profit	42.0	49.4
Not-for-profit	29.0	45.4
Public[b]	29.0	45.4
Hospital accreditation (%)		
Major teaching hospital[c]	9.8	29.7
Minor teaching hospital	32.4	46.8
Community hospital	57.7	49.4
Non-accredited hospital	0.1	3.6
Hospital size (100s of beds)		
Total beds	4.7	5.6
Health service region (%)		
Region 1[d]	26.5	44.2
Region 2	14.7	35.4
Region 3	0.0	0.0
Region 4	21.1	40.8
Region 5	15.1	35.8
Region 6	18.1	38.5
Patient characteristics		
Age (years)	45.5	13.9
Proportion with chronic disorders (%)	58.9	31.7
Proportion male (%)	44.0	22.1
Proportion with diabetes (%)	4.8	11.5
Proportion with arthritis (%)	5.4	14.1
Proportion with heart disease (%)	3.4	10.9
Proportion with psychological disorders (%)	6.3	19.1
Time effects (%)		
1997[e]	7.5	26.3
1998	8.1	27.3
1999	9.4	29.2
2000	9.5	29.3
2001	10.3	30.4
2002	10.7	30.9
2003	10.9	31.2
2004	11.0	31.3
2005	11.2	31.5
2006	11.3	31.7
Sample size (n)	348193	

NT$: New Taiwan dollars.
[a] In 1996,1 NT$=0.0364 US$, annual per capita income in Taiwan=NT$338 582 or US$12 330.
[b] Reference group among the hospital ownership categories.
[c] Reference group among the hospital accreditation categories.
[d] Reference group among the regions.
[e] Reference group among the years.

Results

Table 4 reports the results of estimating the specification using OLS (column 1) and the quantile regression results for the 10th, 25th, 50th, 75th and 90th percentiles. Standard errors (reported in parentheses) are bootstrapped and clustered at the hospital level.[27–29]

Examination of the second row of Table 4 shows that the impact of the global budget in FP hospital departments relative to public hospital departments is positive and significant at all but the lowest percentiles, and that the magnitude rises across the percentiles. These results indicate that, relative to public hospitals, departments in FP hospitals were more likely to increase drug expenditures after the imposition of the global budget, with the positive response being larger as they relied more on drug treatments (i.e. as we move to the right of the conditional distribution of the dependent variable).

NFP hospital departments also increased their drug expenditures relative to public hospital departments, but there is less evidence of significant heterogeneity among departments in the response. Interestingly, these results also show a 'crossover'; at the two lowest quantiles, the relative impact of the global budget is actually greater in NFP than in FP hospital departments. This may be evidence that FP hospitals put greater emphasis on increasing non-drug treatments in departments where the resulting payoff might be larger; that is, where drugs are not much used in treatment.[13] In sum, these results indicate differences in strategies among hospitals with different types of owners, suggesting that FP hospitals responded more aggressively than NFP and especially public hospitals to the incentives created by the special treatment of drug reimbursements within the global budget, particularly in those departments most reliant on drug treatments.

Interestingly, the effect of the global budget on public hospital departments treating non-chronic patients (β_1) shows that these departments decreased drug expenditures, perhaps as part of a general attempt to cut costs.

Finally, the estimated coefficient for the owner-type variable FP shows that the general effect over the whole time period of FP ownership was to reduce departmental drug expenditures relative to those of public hospital departments, particularly at the higher

Table 3. Descriptive statistics of explanatory variables for hospitals in Taiwan during 1997–2006, in a study to identify the effect of the hospital global budget on drug expenditures

	FP hospitals		NFP hospitals		Public hospitals	
	Mean	SD	Mean	SD	Mean	SD
Dependent variable						
Average drug expenditure per hospital department visit (1996 NT$)						
January 1997–June 2002	253.0	252.1	497.2	373.1	470.0	358.3
July 2002–June 2006	352.3	390.0	603.4	479.0	521.1	411.0
Explanatory variables						
Point value of global budget	0.95	0.07	0.95	0.07	0.95	0.07
Hospital characteristics						
Hospital accreditation (%)						
Major teaching hospital[a]	0.0	0.0	20.5	40.4	13.1	33.8
Minor teaching hospital	14.8	35.5	44.7	49.7	45.4	49.8
Community hospital	84.9	35.8	34.7	47.6	41.5	49.3
Non-accredited hospital	0.3	5.6	0.0	0.0	0.0	0.0
Hospital size (100s of beds)						
Total beds	1.8	2.1	6.7	6.2	5.8	5.5
Health service region (%)						
Region 1[b]	15.0	35.7	38.3	48.6	31.4	46.4
Region 2	19.1	39.3	10.1	30.1	13.1	33.8
Region 3	31.6	46.5	13.2	33.9	13.9	34.6
Region 4	12.0	32.5	17.4	37.9	17.4	37.9
Region 5	22.2	41.6	12.2	32.7	18.2	38.6
Region 6	0.1	3.7	8.8	28.4	6.0	23.8
Patient characteristics						
Age (years)	43.9	13.8	46.4	13.5	47.1	14.0
Proportion with chronic disorders (%)	71.0	29.6	51.0	30.1	49.3	30.3
Proportion male (%)	44.4	23.7	43.2	19.4	44.2	22.3
Proportion with diabetes (%)	4.0	10.1	5.2	12.6	5.7	12.2
Proportion with hypertension (%)	6.5	13.4	7.9	15.5	8.5	15.8
Proportion with arthritis (%)	4.6	12.3	5.2	13.8	6.8	16.4
Proportion with heart disease (%)	3.0	10.2	3.4	11.2	3.8	11.3
Proportion with psychological disorders (%)	4.6	15.5	6.4	18.8	8.8	23.4
Time effects (%)						
1997[a]	7.9	26.9	5.9	23.6	7.4	26.1
1998	8.8	28.4	7.4	26.1	8.6	28.0
1999	9.7	29.5	8.7	28.2	9.8	29.7
2000	9.9	29.9	9.0	28.5	9.7	29.5
2001	10.4	30.6	10.2	30.2	10.7	30.9
2002	10.5	30.6	10.8	31.1	11.0	31.3
2003	10.6	30.8	11.2	31.5	11.1	31.4
2004	11.0	31.3	11.8	32.3	10.2	30.2
2005	10.8	31.0	12.2	32.8	10.7	30.9
2006	10.3	30.5	12.8	33.4	10.9	31.2
Sample size (n)	146 198		101 117		100 878	

FP: for-profit; NFP; not-for-profit; NT$: New Taiwan dollars.
[a] Reference group among the hospital accreditation categories.
[b] Reference group among the health service regions.

Table 4. Impact of global budget and type of hospital ownership on average hospital drug expenditures, by hospital department, in Taiwan, 1997–2006

	Quantiles					
Variables[a]	OLS	0.1	0.25	0.5	0.75	0.9
After global budget	−0.0550*** (0.006)	−0.089*** (0.014)[b]	−0.060*** (0.010)	−0.046*** (0.007)	−0.035*** (0.009)	−0.039** (0.016)
After global budget* FP	0.0360*** (0.003)	0.013 (0.015)	0.019** (0.010)	0.021** (0.009)	0.036*** (0.010)	0.052***(0.016)
After global budget* NFP	0.0378*** (0.004)	0.032** (0.015)	0.025** (0.010)	0.022*** (0.008)	0.027*** (0.009)	0.035** (0.016)
FP	−0.0425*** (0.003)	0.011 (0.017)	−0.000 (0.010)	−0.019** (0.008)	−0.044*** (0.011)	−0.066*** (0.014)
NFP	0.0131*** (0.003)	0.038* (0.020)	0.023** (0.012)	0.008 (0.008)	−0.004 (0.009)	−0.012 (0.015)
After global budget* chronic patients (%)	0.1029*** (0.005)	0.161*** (0.016)	0.098*** (0.009)	0.064*** (0.008)	0.045*** (0.009)	0.055*** (0.015)
Observations (n)	348 193	348 193	348 193	348 193	348 193	348 193
R-squared	0.818					

FP: for-profit; NFP: not-for-profit; OLS: ordinary least squares.
[a] All specifications include all variables listed in Table 2 and a monthly trend term.
[b] Boot-strapped standard errors, clustered by hospital, are in parentheses.
***p<0.01, **p<0.05, *p<0.1.

percentiles, presumably because the presence of a residual claimant may have caused these departments to try harder to reduce their costs. Private NFP hospitals, on the other hand, tended to spend more than public hospitals, most significantly in the lower percentiles.

We also conducted interquartile tests using Stata code ^*iqreg*^ to check whether differences across the quantiles are significant. Table 5 displays the results of interquartile tests. We found that while there are no significant differences in the coefficients of variable of interest across quantiles below the median, the differences between quartiles above the median are statistically significant.

Sensitivity tests

We performed two sensitivity tests. First, we added seasonal dummies in addition to the monthly trend and the year fixed effects variables in case there were regularities in drug expenditures associated with seasonal conditions such as the weather. Inclusion of these variables did not affect our results. Second, we re-ran our specification excluding departments for which there were fewer than 30 observations (i.e. departments that we observed in the data set for fewer than 10 quarters) in case the behavior of newly entered departments or exiting departments biased our results. Again, we found that our main results were not affected by this exclusion although we did find that the exclusion of these short-lived departments reduced the size and significance of the response to the global budget by departments in NFP hospitals. (Results with seasonal variables and with departments with fewer than 30 observations excluded are available on request.)

Discussion

We used quantile regression to study the impact of Taiwan's global budgeting system on the drug expenditures of hospital departments in hospitals with different types of owner. While we find, as in other studies, that the overall response of hospital departments to the global budget was to increase drug expenditures, we also find significant heterogeneity in departmental responses. Departments within FP hospitals show small or insignificant increases in drug expenditures by low quartile departments and increasing expenditures by high quartile departments; NFP hospital departments also show increases at all percentiles, but with much less variation in their response. Public hospital departments, by contrast, show large positive increases in the lowest percentile departments, with the effect disappearing by the 75th percentile. Our results suggest that both owner type and department type influence the change in drug use that followed implementation of the global budgeting system.

A limitation of this study is that we are uncertain as to exactly how the changes in expenditure are affecting patient care and outcomes. For example, while we observe that FP hospitals increased drug expenditures in high percentile departments, we cannot be sure whether the drug expenditures are increasing because more drugs are being prescribed than in the past for the same condition, or because of an increase in the use of drugs instead of non-drug treatments. Further, we have not investigated the financial impact of the response of FP hospitals to the

Table 5. Impact of global budget and type of hospital ownership on average drug expenditures, by hospital department (interquartile effects), in Taiwan, 1997–2006

	Interquartiles			
Variables	0.10∼0.25	0.25∼0.5	0.5∼0.75	0.75∼0.90
After global budget	0.027*** (0.008)	0.015*** (0.004)	0.011*** (0.004)	−0.003 (0.007)
After global budget* FP	0.005 (0.005)	0.001 (0.003)	0.014*** (0.003)	0.016*** (0.003)
After global budget* NFP	−0.006 (0.004)	−0.004* (0.002)	0.005** (0.003)	0.008** (0.004)
FP	−0.008** (0.003)	−0.018*** (0.002)	−0.025*** (0.002)	−0.022*** (0.003)
NFP	−0.016*** (0.003)	−0.014*** (0.001)	−0.013*** (0.002)	−0.008** (0.002)
After global budget* chronic patient (%)	−0.060*** (0.006)	−0.034*** (0.004)	−0.019*** (0.004)	0.010 (0.006)
Observations (n)	348 193	348 193	348 193	348 193

FP: for-profit; NFP: not-for-profit.
[a] All specifications include all variables listed in Table 2 and a monthly trend term.
[b] Boot-strapped standard errors, clustered by hospital, are in parentheses.
***p<0.01, **p<0.05, *p<0.1.

global budgeting system. These questions are important and deserve additional study.

Conclusion

Government-provided healthcare programs are likely to continue to experience financial pressure, and a global budgeting system may be an effective means of managing expenditures. However, the details of such a system must be carefully designed to avoid giving healthcare providers incentives to behave in ways that undermine cost containment goals or the quality of patient care. Our findings suggest that all healthcare providers altered medical treatments in response to imposition of the global budget. However, given that use of drugs was likely also influenced by the previous reimbursement system, it is impossible to say which change may have improved health care or made it worse. More research is needed to determine whether these very different responses had significant impacts on the quality of health outcomes for the patients affected.

Authors' contributions: SYC and JHZ conceived the study; SYC and JHZ designed the study protocol; HML provided the data; JHZ carried out the estimations; SYC, MED, HML and JHZ analyzed and interpreted the results. MED drafted most of the manuscript; SYC, HML and JHZ critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. JHZ and SYC are guarantors of the paper.

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